ZERO CLEARANCE C-RING ASSEMBLY

BACKGROUND OF THE INVENTION

[1] This invention was made with Government support under contract N00019-02-C-3003 awarded by the United States Navy. The Government has certain rights in this invention.

[2] This application relates to a unique holding assembly using a C-ring without the requirement of any clearance axially inward for the C-ring.

[3] C-rings are often used to hold loaded assemblies in a fixed location. C-rings are desirable because they are an efficient mechanism to retain highly loaded assemblies using a minimal support structure (radially and axially) relative to conventional closures (i.e., threaded caps). In general, a C-ring is a spring biased, ring shaped device that has two ends opposed to each other at a defined distance to allow for compression during assembly. In conventional assemblies, the mechanism being retained is axially compressed beyond its intended position to allow the C-ring to be installed. Thus, axial clearance is required.

[4] The requirement of axial clearance has limited the use for C-rings. In particular, there are many combinations where it would be desirable to use C-rings, however the assemblies being retained cannot accommodate the axial clearance required to install the C-ring and therefore the C-ring has not been able to be used.

[5] The present invention provides a C-ring assembly that overcomes this shortcoming and allows the use of the C-ring and all its benefits to be used.

SUMMARY OF THE INVENTION

[6] The present invention discloses a C-ring assembly. In particular, the C-ring is initially installed into the groove, and then catch plates or holding members are slid under the C-ring. The holding members provide the support to retain the assembly.

[7] In a most preferred embodiment, the holding members include at least two holding members that together provide support over a portion of the circumference of the C-ring. Due to the small circumferential extent of the two holding members, each may be easily moved into the opening of the C-ring and then snapped into place. In a most preferred embodiment, a locking plate is then moved between the two holding members. The locking plate further supports the catch plates that complete the circumferential support for the C-ring.

[8] In this way, no clearance is required. Instead, the C-ring is moved into place, and the holding members and locking plate are then assembled within the C-ring. The present invention thus allows the use of a C-ring without the requirement of clearance.

[9] A most preferred application of this C-ring assembly is utilized in a spool valve to hold the porting sleeve relative to the housing at a desired location.

[10] These and other features of the present invention can be best understood from the following specification and drawings, the following of which is a brief description.

BRIEF DESCRIPTION OF THE DRAWINGS

[11] Figure 1A is a cross-sectional view through an example spool valve incorporating the present invention.

[12] Figure 1B shows the basic structure of a C-ring.

[13] Figure 2 is an exploded view of the inventive C-ring assembly.

[14] Figure 3 is a cross-sectional view along line 3-3 as shown in Figure 1.

DETAILED DESCRIPTION OF THE DRAWINGS

[15] A spool valve 20 is illustrated in Figure 1A received within an outer housing 21. A piston 22 is movable within a porting sleeve 23. As is known, a number of inlet and outlet ports communicate with openings within the porting sleeve, and further with various openings within piston 22 and housing 21. Such ports and openings would vary with the application of spool valve 20, and those illustrated are merely exemplary. A boss 24 is formed at a forward end of piston 22 and abuts an inner surface 26 of the porting sleeve 23. A forward end 28 of the sleeve 23 abuts a closure plate 30 at face 32. A C-ring 34 is received in a groove 36 in the housing 21 and further in a groove 38. A locking plate 40 incorporates support structure 42 positioned between two circumferentially spaced catch plates or holding members 37. Pins or bolts 43 fix the locking plate 40 to the closure 30.

[16] Figure 1B shows C-ring 34 having spaced ends 48.

[17] As shown in Figure 2, the outer housing 21 receives closure plate 30 and the C-ring 34. The holding members 37 each have generally circular outer and inner peripheral surfaces, but each of which extend less than 180° about a center axis. Holding members 37 have groove portions 38 at an outer periphery. Groove portions 38 are preferably curved to provide support over the entire surface of the C-ring.

[18] As can be appreciated, an upper support structure 42 includes grooves 51. The ends 48 of the C-ring move into those grooves 51. A ledge 53 intermediate the grooves 51 extends between the ends 48 of the C-ring when assembled. As can be appreciated from Figure 3, an opposed structure 42 may have a groove 55 across its circumference such that the C-ring 34 can sit in the groove.

[18] As can be appreciated from Figure 3, the support structures 42 on the locking plate 40 extend into and between the circumferential ends 47 of the holding member 37. Thus, when assembled, the support structures 42 abut ends 47 of the holding members 37 such that between the two support structures 42 and the two holding members 37, there is complete circumferential support for the locking ring 34.

[19] Now, when assembling the valve of Figure 1A utilizing the inventive C-ring support structure, one initially places the porting sleeve 23 within the housing 21. The piston 22 is then inserted. The closure plate 30 is then inserted. The C-ring 34 is then moved into groove 36. One of the holding members 37 is then moved into the interior of the C-ring 34, and then moved radially outwardly to engage the C-ring in groove portion 38. The other holding member 37 may then be mounted in a similar fashion.

[20] Locking plate 40 is then moved into the housing 21 with the support surfaces positioned between the end surfaces 47. Pins or bolts 33 are then inserted through the openings 44 and into openings 46 in the plate closure, locking the elements together. In this fashion, porting sleeve 23 need not move axially, but a C-ring can still be utilized. This "zero clearance" assembly thus benefits from the use of a C-ring to hold the locking sleeve 23 relative to the housing 21.

[21] Of course, many other applications, including applications beyond valves, will benefit from this assembly.

[22] Although a preferred embodiment of this invention has been disclosed, a worker of ordinary skill in the art would recognize that certain modifications would come within the scope of this invention. For that reason, the following claims should be studied to determine the true scope and content of this invention.